USMS Workshop on Micro Nano Technologies

12:00 Working Lunch - Workshop Introduction

- 12:30 David Hermreck, NIST – USMS initiative
- 12:40 Gary Fedder, CMU – Metrology Systems Perspective on Micro/Nano Devices
- 1:00 Robert Scace, Klaros Corporation - Industry Standards on Micro/Nano Systems
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4:00 Summaries and Discussion

5:00 Adjourn

September 22, 2005

Materials and Handouts

- CD Handout on NIST Activities
- White Paper
- List of Discussion Groups
- List of Questions

Summary of NIST Activities

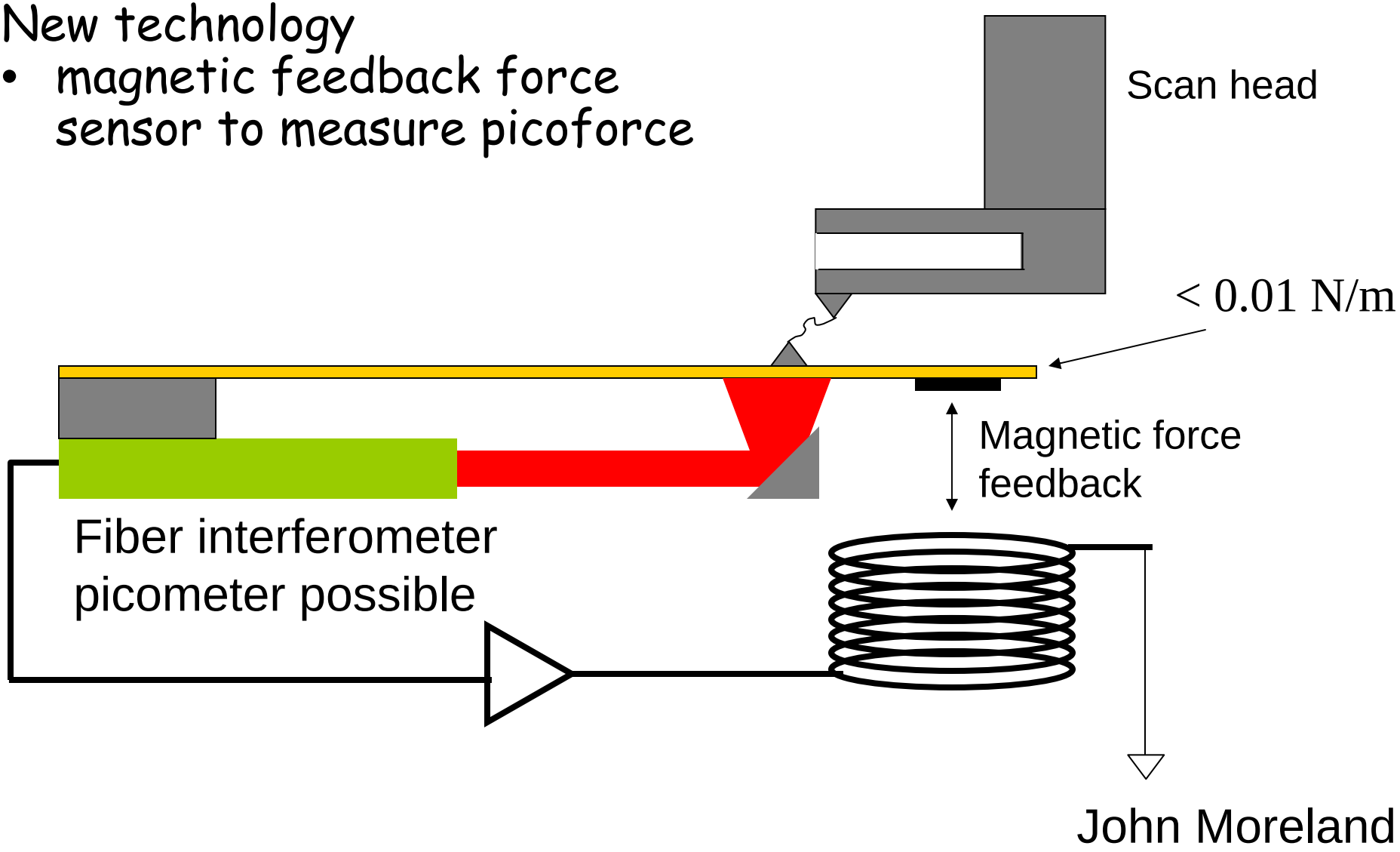
- Applications
  - NIST uses Micro Nano Technologies to create tools to improve our measurement capabilities
- Standardization
  - NIST works with standards organizations

Problem with OMP Links: got to http://www.eeel.nist.gov/omp

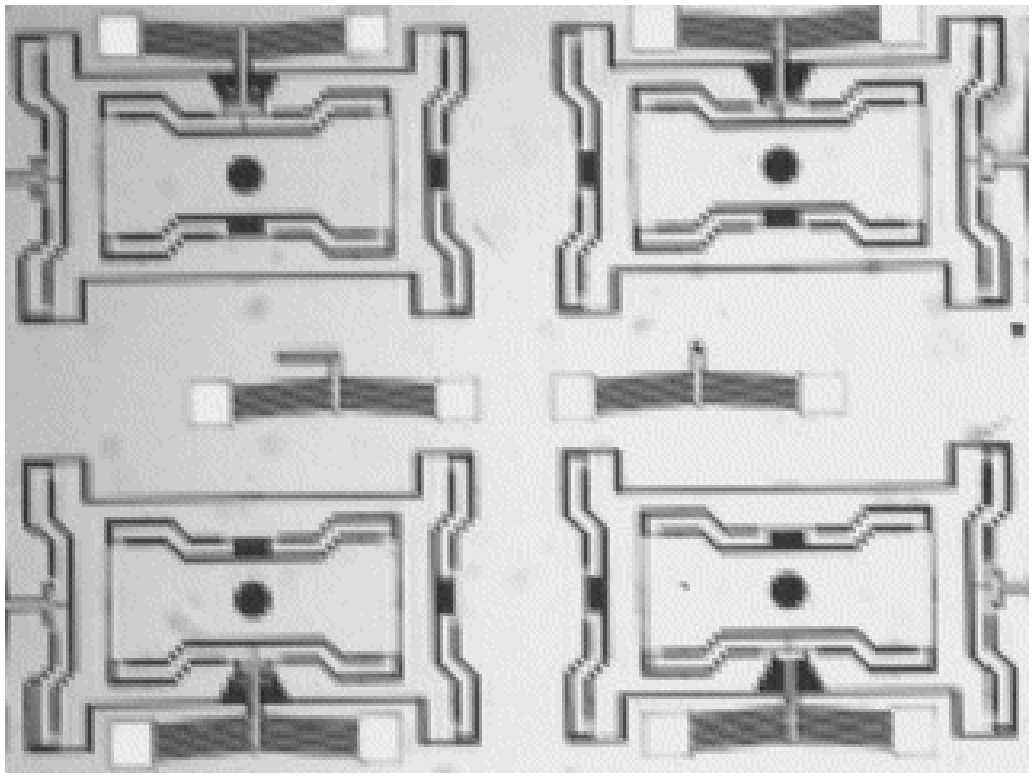
New low-force detection scheme will push force range of AFM downward

New technology

- magnetic feedback force sensor to measure picoforce



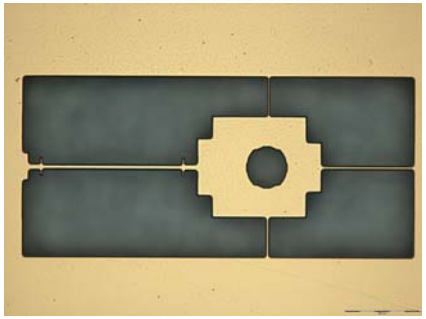
Micro/Nano Positioners



Light microscope picture of a 2x2 array of MEMS scale X-Y axes Dual Parallel Cantilever Micro/Nano Positioners.

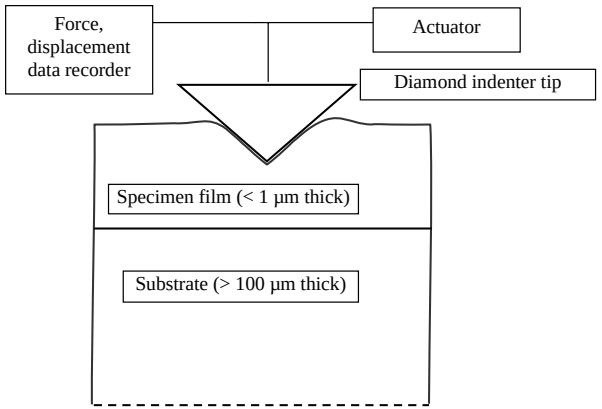
Nic Dagalakis

Mechanical Characterization in Small Volumes: Measurement Methods Reach Toward Atomistic



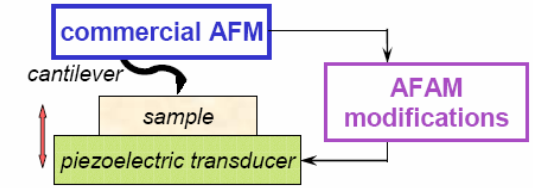
Microtensile

~1x10x 200 µm



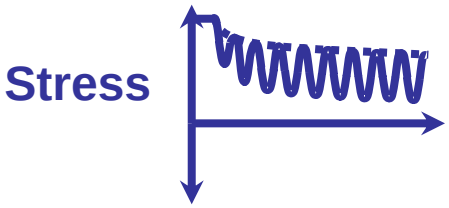
Instrumented indentation:

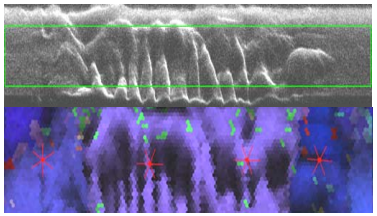
~0.2 x 1 x 1µm



AFM-based:

100 x 100 x 100 nm



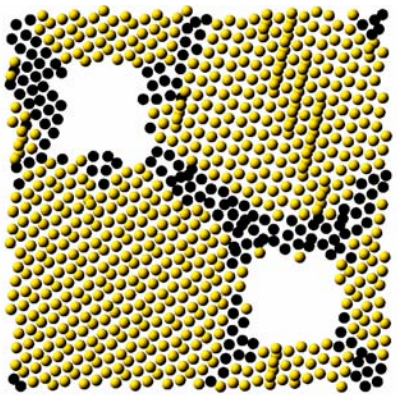


Strain

Electrical-mechanical: Joule heating

>> thermal cycles >> mechanical strain

Conductor width



Atomistic models:

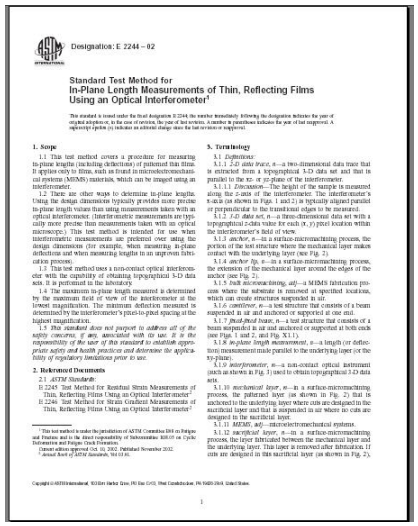
How reliable?

David Read

What New Measurement Methods Are Needed?

- Some that I heard at this meeting
  - Nondestructive inspection of deep features
  - Also buried features
  - Noninvasive measurement of mechanical properties of thin films (laminates)

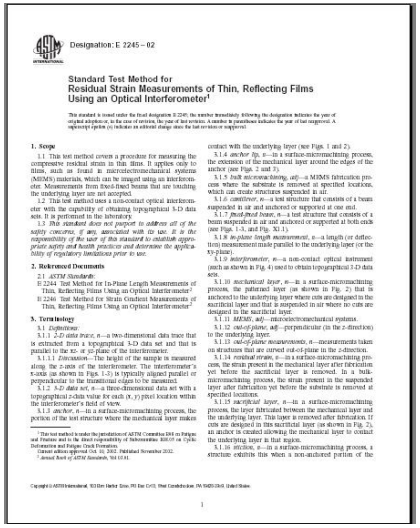
3 MEMS ASTM Standard Test Methods



Designation: E 2244 – 02

Standard Test Method for
In-Plane Length Measurements of Thin, Reflecting Films
Using an Optical Interferometer[1]

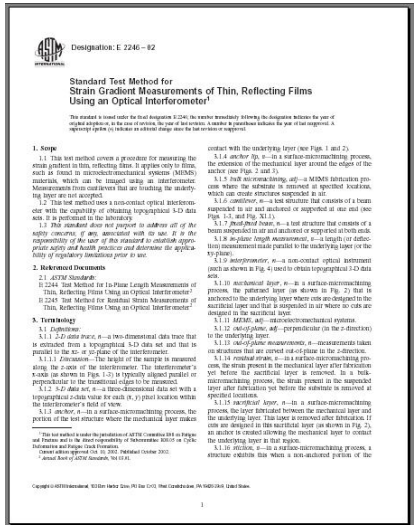
E 2244
in-plane length



Designation: E 2245 – 02

Standard Test Method for
Residual Strain Measurements of Thin, Reflecting Films
Using an Optical Interferometer[1]

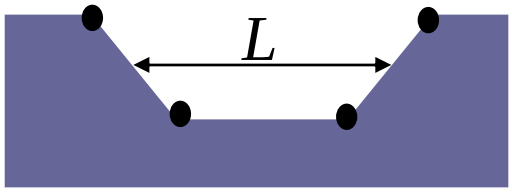
E 2245
residual strain

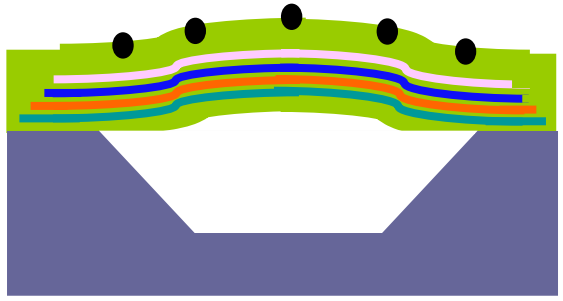


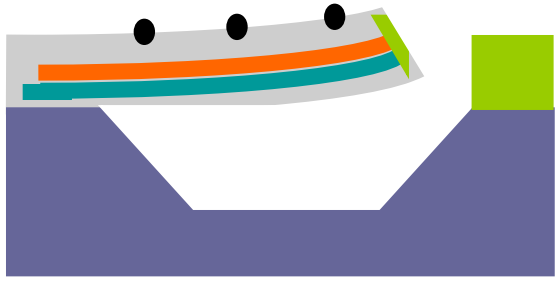
Designation: E 2246 – 02

Standard Test Method for
Strain Gradient Measurements of Thin, Reflecting Films
Using an Optical Interferometer[1]

E 2246
strain gradient







Janet Marshall

What New Standards Are Needed

- Some that I heard at this meeting
  - Test structure standards are good start
  - Alternative methods needed

Workshop Business

- *Workshop Goal*: To produce a “summary” report that identifies and prioritizes current and future metrology needs of the MNT industry.
- We will hear introductory talks to stimulate thinking.
- We will split into workgroups to discuss needs by technology area
- We will reconvene back together to hear these results and have further opportunity for discussion

After the Workshop

- A draft summary report will be completed by October 7.
- The report will be sent to you for comments.
- Comments will be due back at end of October.
- The final report will be completed by November 10.

Workgroups

- Mechanical Sensors and Actuators
- Microfluidics
- MOEMS
- RF MEMS
- Data Storage
- Packaging
- Process Monitoring and Characterization
- BioMEMS.

Questions

What do you Need?

- Metrology Needs Analysis
- Materials Properties
- Test Structure Development
- Inspection Tools
- Modeling and Measurement
- Device Failure and Diagnostics

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